

ILA LFVC Model Solutions

Spring 2016

1. Learning Objectives:

4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:

- (4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.
- (4b) Apply methods and principles of embedded value.
- (4f) Explain and apply methods in earnings management and capital management.

Sources:

LFV-137-16: Kraus 2011 – EVARAROC vs. MCEV Earnings – A Unification Approach

Commentary on Question:

This question tested the candidate's understanding of performance metrics comparing EVA/RAROC to MCEV earnings.

Candidates were expected to understand the underlying concepts and demonstrate their comprehension through the quality and correctness of their error analysis

The candidate was expected to assess and justify the accuracy of a series of statements. True statements were not expected to provide a justification for full credit. False statements required identification of what is incorrect and some explanation of what would be correct.

To receive full credit, candidates were required to clearly identify whether a statement was true or false, which some failed to do. Some candidates who correctly identified a statement as false did not give sufficient justification as to why.

1. Continued

Solution:

Assess the accuracy of each of the following statements with regard to the use of performance metrics for value-based management of insurance business. Include any necessary recommendations to correct the statements.

- A. *Economic value added (EVA) and risk-adjusted return on capital (RAROC) are good performance metrics for life insurance.*
- B. *There is an important connection between the cost of capital and solid enterprise risk management (ERM).*
- C. *The cost of capital can be interpreted as the minimum rate of return on equity capital that is required by the shareholders to make it worthwhile to invest in a company. The correct cost of capital rate is essential to measuring performance.*
- D. *Traditional accounting-based performance measures such as return on equity (ROE) or return on investment (ROI) evaluate performance and provide good indications for relative performance measurement and value creation.*
- E. *Businesses should distinguish forward-looking objectives, such as target setting and decision making, from backward-looking objectives, such as performance evaluation and compensation schemes.*
- F. *Market-based measures of return are superior to accounting-based measures of return.*
- G. *The market consistent embedded value (MCEV) corresponds to the value of the business at one specific point in time and is a good measure for managerial performance.*
- H. *For operating variances there is no need to separate between experience variances and assumption changes. The MCEV methodology makes implicit allowances for change in all assumptions as it is based on market consistent values.*
- I. *The total MCEV earnings should be used for managerial performance evaluation.*
- J. *In order to measure the true value creation of MCEV earnings, the unwinding of the inforce business needs to be included since there is no additional value creation by the expected business contribution.*

1. Continued

A. FALSE

- EVA and RAROC focus on the performance of specific periods and do not take into account future profits that can be expected from existing business.
- MCEV is more appropriate for considering cash-flows from long-term business such as life insurance

B. TRUE

- With a unique and complex risk landscape compared to other industries there is a need for proper risk and capital management.
- Shareholders require a particular rate of return which needs to be measured within the context of performance measurement and reporting
- Identifying the correct cost of capital is one of the central tasks for measuring value in the insurance industry
- Clear connection between risk management and value creation is the core of a solid ERM

C. TRUE

- the cost of capital varies across industries and across lines of business in the insurance industry
- Important in considering a multi-line pricing and capital allocation for insurance companies
- There are different models for estimating the cost of equity capital for property-liability reserves with different business line composition

D. FALSE

- ROE and ROI are without any consideration of risk and uncertainty components
- This can lead to misleading indications of relative performance measurement and value creation

E. TRUE

- there is a natural split in performance metrics between evaluation before the performance has actually occurred and evaluation after the performance has taken place.
- EVA and RAROC are used for both

1. Continued

F. FALSE

- There are differences that need to be understood.
- Traditional accounting based measures fail to assess the market based measures or return because they are based on historical asset values which are distorted by inflation and other factors
- The EVA presents the difference between the accounting rate of return and the market rate of return required by shareholders.
- The MVA is the present value of all future accounting biases and can be referred to as the franchise value.
- The use of valuation models based on discounted cash flows to reduce the accounting bias and bring accounting based performance measures more into line with market based measures (similar to residual income valuation models).
- Embedded value reporting is intended to minimize accounting bias
- To fully eliminate the bias future new business has to be integrated into the valuation model

G. FALSE

- Need to analyze the change in MCEV over time to use for managerial performance and decision making
- Detailed movement analysis of MVEV earnings provides helpful information for management and can be a good indicator for value creation
- Detailed movement analysis helps sort out the value creation (or destruction of the in-force)

H. FALSE

- This is true for economic variances and economic assumptions
- Operating variances are divided into non-economic variances affected by experience variances (changes from variance between actual experience and anticipated) and assumption changes (changes in the experience assumptions).
- It is important to identify, explain, and disclose the different kinds of variances in the MCEV reporting

I. FALSE

- Management does not have any impact on economic variances
- Companies can disclose information about the operating return which attempts to exclude the change in economic assumptions.

J. FALSE

- The unwinding should be EXCLUDED
- For calculation of the total unwinding effect separate the unwinding effect of the PVFP, the cost of residual non-hedgeable risks, frictional costs of required capital.

2. Learning Objectives:

5. The candidate will be able to evaluate various forms of reinsurance, the financial impact of each form, and the circumstances that would make each type of reinsurance appropriate.

Learning Outcomes:

- (5a) Describe the considerations and evaluate the appropriate reinsurance form from the ceding and assuming company perspectives.
- (5b) Explain the consequences and calculate the effect on both ceding and assuming companies with respect to:
- (i) Risk transfer
 - (ii) Cash flow
 - (iii) Financial statements
 - (iv) Reserve credit requirements
 - (v) Tax

Sources:

Life, Health & Annuity Reinsurance, Tiller, 3rd Edition, Ch. 4-6

Commentary on Question:

This question tested the candidates' understanding of the various forms of reinsurance and the considerations to evaluate the appropriate form of reinsurance from the ceding company perspective. Candidates were expected to demonstrate their understanding of the consequences and the effect on both ceding and assuming companies with respect to risk transfer, cash flows and reserve credit treatment. In addition, candidates were required to demonstrate the impact to mortality risk of excluding non-forfeiture options and policy loan.

Solution:

- (a) Explain how an insurance company can use reinsurance on an inforce block as part of its financial strategy.

Commentary on Question:

This question tested the candidates' knowledge of the use of reinsurance as part of companies' financial strategy. Most candidates understood the major reasons as capital and tax relief. Not all candidates identified using the ceding company's expertise or the using reinsurance to recapture a block of business.

2. Continued

An insurance company can use reinsurance on an inforce block as part of its financial strategy to:

- Cede business to reduce required capital
- Cede business to optimize the use of tax losses
- Ceding commission will have a positive effect on earnings and surplus
- Use of mod co (or other forms) leave the assets with the ceding company
 - This will not trigger a capital gain/loss
 - The ceding company retains the investment policy
 - The reinsurer can utilize the cedant's expertise
 - There is no concern for the reinsurer's credit quality
 - Recapture can be more easily accomplished
 - Aligns the cedant's and reinsurer's view of earned and credit rate

(b)

- (i) Describe the characteristics of modified coinsurance (mod-co).
- (ii) List two advantages and two disadvantages of mod-co.

Commentary on Question:

Most candidates were able to list some of the characteristics of mod-co reinsurance (asset remaining with ceding company and mod-co adjustment). Candidates needed to provide a more complete list to receive full grading points.

Characteristics of modified coinsurance include:

- The ceding company maintains the reserves and the assets backing the reserves
- There is a proportional sharing of premiums, benefits, and reserve increases
- The reinsurer pays the ceding company an allowance to provide gains and cover ceding company expenses
- A mod-co adjustment is used for the increase of statutory reserve increase of the ceded portion.

Advantages of mod-co include:

- Ceding company avoids transferring ownership of the assets
- Ceding company receives reserve credit even if the reinsurer is not licensed in the ceding company's state of domicile
- The reinsurer may not prefer to manage the assets

2. Continued

Disadvantages of mod-co include:

- Mod-co is complicated to administer
- Transfer of assets back to the reinsurer in the event of treaty termination could create exposure to capital loss for the ceding company
- Transfer of the initial mod-co adjustment could create the same problem for the reinsurer
- Special transactions are needed in the case of surrender or death
- The reinsurer is exposed to the ceding company's credit risk

(c) Calculate the following for each year:

(i) Gain or loss to JZ Life each year under the base scenario.

(ii) Gain or loss to CM Re each year under the catastrophe scenario.

Show all work.

Commentary on Question:

Most candidates were able to calculate the net premium, expense allowance and net claims. However, most candidates were not able to calculate the risk charge correctly (generally not applying the 90% reinsurance factor). Candidates that demonstrated full understanding of the key components of the calculation received most of the grading points. Full grading points were awarded only if there were correct calculation for all years.

	Base			
Cedant	2017	2018	2019	
Gross Premium	200	210	200	
Ceded Premium	180	189	180	=90% * Gross Prem
Net Premium	20	21	20	=Gross Prem less Ceded Prem
Expense Allowance	18	18.9	18	=10% * Ceded Prem
Total Revenue	38	39.9	38	=Net Prem + Exp Allowance
Gross Claims	140	147	140	
Ceded Claims	126	132.3	126	=90% * Gross Claim
Net Claims	14	14.7	14	=Gross Claim less Ceded Claim

2. Continued

Required Capital	50	52	50	
Risk Charge	4.5	4.68	4.5	=Req Cap * 200% * 90% * 5%
Total Benefits	18.5	19.38	18.5	=Net Claims + Risk Charge
Net Income	19.5	20.52	19.5	=Total Revenue less Total Ben

Catastrophic

Reinsurer	2017	2018	2019	
Premium	180	162	144	=90% * Gross Prem
Risk Charge	4.68	5.04	5.4	=ReqCap * 200% * 90% * 5%
Total Revenue	184.68	167.04	149.4	=Prem + Risk Charge
Expense Allowance	18	16.2	14.4	=10% * Ceded Prem
Claims	180	207	252	=90% * Gross Claims
Total Benefits	198	223.2	266.4	=Exp Allowance + Gross Claims
Net Income	-13.32	-56.16	-117	=Total Revenue less Total Ben

(d) The catastrophe scenario in part (c) excludes the following:

- 40% of the policies of this block are eligible for non-forfeiture options.
 - Policyholders are eligible to take policy loans, and the utilization has been volatile over the years.
- (i) Assess how these exclusions affect the mortality risk to CM Re.
- (ii) Describe how these exclusions would be handled in a reinsurance transaction.

Commentary on Question:

Most candidates correctly demonstrated that mortality risk could increase due to the exclusion of the non-forfeiture option. However, most candidates stated that policy loan exclusions should not impact mortality risk. In addition, most candidates could only identify 'the provisions in the reinsurance treaty' as a way to handle the exclusions.

2. Continued

- (i) The mortality risk could increase due to the exclusion of the non-forfeiture option.
The mortality risk could decrease due to the exclusion of policy loan.
- (ii) Ways to handle the exclusions include:
 - The reinsurance treaty should describe how the amount of reinsurance is treated
 - The reinsurer could fulfill its obligation by paying an amount equal to the statutory reserve for the benefit – this eliminates the difficult task of administering these benefits
 - Stress test should be revised to include the consideration of non-forfeiture option and policy loans.

3. Learning Objectives:

3. The candidate will understand and apply emerging financial and valuation standards, principles and methodologies.

Learning Outcomes:

- (3a) Describe, evaluate and calculate the impact on reserves, income, capital, and processes of emerging developments in Statutory and U.S. GAAP reporting, International Financial Reporting Standards, and Solvency Modernization.

Sources:

LFV-134-16: Ready or Not, Here it Comes, include Appendix 2, PWC

Commentary on Question:

This question tests the candidate's knowledge of International Financial Reporting Standards. To receive full credit for Part (a), the candidate needed to clearly indicate if the statement is correct, and if not correct, recommend how to correct it. To receive full credit for Part (b), the candidate needed to describe the key areas and concerns.

Candidates generally performed poorly on this question, particularly on Part (b) where most candidates demonstrated a lack of understanding of the topic.

Solution:

- (a) Assess the accuracy of each of the following statements with regard to tentative decisions made by the IASB during its re-deliberations on the IFRS for insurance contracts. Include any necessary recommendations to correct the statements.
- A. *Changes in the discount rate are presented in other comprehensive income (OCI).*
- B. *Investment components are excluded from revenue.*
- C. *Premiums written are presented in the income statement.*
- D. *The day one locked-in discount rates are used to accrete interest on the contractual service margin (CSM) and calculate the subsequent adjustments that unlock the CSM.*
- A.
- This statement is partially correct
 - changes in discount rate can be presented in either profit or loss or OCI
- B.
- This statement is correct

3. Continued

C.

- This statement is not correct
- presentation of premiums due or written in the income statement is prohibited

D.

- This statement is correct

(b) The IASB continues to discuss a number of matters surrounding the treatment of participating insurance contracts under IFRS.

(i) Describe the five key areas under discussion.

(ii) Describe any concerns an insurance company may have with the IASB's proposals regarding these five key areas.

(i)

1. Scope

- need to clarify which contracts the separate model would apply to
- may divide contracts which result in payments to policyholders that vary with returns on underlying items into separate categories

2. Splitting of cash flows

- rethinking proposed requirement to split cash flows into three types
- approaches that do not involve the splitting of cash flows are also being explored, including a mirroring exception

3. Determining interest expense in profit or loss

- need to determine discount rate
- looking at both book yield and effective yield approaches

4. Unlocking and amortization of the CSM

- need to clarify the circumstances under which the CSM is unlocked and amortized
- unlocking could be permitted for certain contracts when the change is viewed as an implicit management fee
- need to determine what constitutes an appropriate pattern for the transfer of services used to release the CSM in profit or loss over the life of the contract

3. Continued

5. Presentation of changes in the value of options and guarantees
 - contracts within the scope of the mirroring exception: considering presenting all changes in profit or loss
 - contracts outside the scope of the mirroring exception: considering splitting changes between profit or loss, OCI and CSM unlocking depending on the driver

(ii)

1. Scope
 - complications and additional costs associated with dividing contracts
 - potential for clouding of financial results due to different presentations for contracts in scope vs. out of scope
 - until the final model is determined, it is unclear whether being within or outside the scope will significantly affect the measurement of the liability and income statement presentation
2. Splitting of cash flows
 - approaches requiring splitting: complex, potentially arbitrary and potentially result in accounting mismatches
 - approaches not involving splitting: companies are generally supportive
3. Determining interest expense in profit or loss
 - potential for accounting mismatches
4. Unlocking and amortization of the CSM
 - potential for unrealistic representation of performance
5. Presentation of changes in the value of options and guarantees
 - companies are generally supportive of the direction in which IASB is heading

4. Learning Objectives:

1. The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.

Learning Outcomes:

- (1e) Explain the role and responsibilities of the appointed/valuation actuary.

Sources:

CIA Educational Note: Dividend Determination for Participating Policies, January 2014

CIA Educational Note: Guidance on Fairness Opinions Required Under the Insurance Companies Act Pursuant to Bill C-57 (2005)

LFV 606 16: OSFI Guideline Min Continuing Capital and Surplus Req MCCSR

LFV-635-13: Participating account management and disclosure to par policyholders

Commentary on Question:

This question tested the candidate's knowledge of how an actuary assesses fairness in management of a participating block of business.

Most candidates relied on retrieval in their responses, earning partial credit for their answer. Few displayed the required levels of comprehension and knowledge utilization to earn full credit.

Solution:

- (a) Describe the relevant experience factors considered in the determination of dividends for LifeCo's par product.

Commentary on Question:

Most candidates were able to list a portion of the relevant experience factors but few provided an adequate description to receive full points

Claims

- Represents the rate of annual mortality/morbidity for the product
- Age, sex, risk selection class, and time since issue may impact these factors
- Mortality, not morbidity, is the primary risk for LifeCo's product

Termination Rates

- Represents the experience for annual rates of termination other than mortality/morbidity
- For this product, the relevant experience is policy lapsation
- Age, sex, time since issue, risk selection class, frequency of premium payment, size of policy, and moneyness of any guarantees may impact these factors

4. Continued

Expense Rates

- Represents the experience for direct expenses that can be specifically related to a particular policy such as commissions, underwriting, and policy issue expenses
- Also incorporates indirect expenses which may be allocated such as overhead expenses which are fairly allocated to relevant groups of policies

Investment Income

- Reflects the investment experience of the par fund, including interest income, investment expenses, capital gains and losses
- Usually a major component in the amount of dividends paid
- May use a portfolio average or investment generation approach
- May be impacted by permanent/temporary tax differences, the amount and timing of cashflows, asset income rates, and investment rollovers

Taxes

- Represent the allocation of taxes to the par fund
- Should be specified in the par account management policy
- May be included as an explicit expense factor or included in another factor such as investment income

(b) Determine whether the following dividend practices are fair. Justify your answers.

A. *Dividend policy indicates that investment experience is smoothed in over 5 years. The actuary decides that to increase dividends this year, investment gains will be smoothed in over 2 years instead.*

B. *Tax legislation is such that one cohort of policies is subject to additional taxes. This cohort is managed with a lower dividend scale.*

Commentary on Question:

Most candidates were able to correctly identify if the practice was fair, but few were able to provide enough justification to receive full credit.

A. This practice is **not fair**

- LifeCo has an established dividend policy that is not being applied consistently over time
- Smoothing should only be used to avoid undue yearly fluctuations, not to artificially increase dividends for a short period of time

4. Continued

B. This practice is **fair**

- There should be no post issue classifications, except as justified by external circumstances outside of the control of the company that arise post-issue
- A change in tax legislation is outside of the company's control and occurred after issue, therefore this is appropriate

(c) Based on the experience, the dividend actuary proposes a reduction in the dividend scale to recover past investment losses.

- (i) Critique the dividend actuary's proposal with regards to policyholders' reasonable expectations and LifeCo's practices.
- (ii) Assess whether LifeCo's block of par policies would qualify under MCCSR guidelines for reduced risk factors.

Commentary on Question:

Most candidates were able to identify if the proposals were appropriate, but few were able to provide sufficient analysis to receive full credit

- (i)
 - The proposal does not consider that Policyholder Reasonable Expectations (PRE) has been created
 - Negative experience may not be able to be passed through as suggested
 - Non-action to pass through investment losses over the last 10 years even though experience would warrant it
 - Client illustrations that show long term compounding benefit projections without showing clients the potential for changes due to changes in dividend scale.
 - Illustrations show current dividend scales only
 - Candidate should conclude that the dividend scale cannot be reduced as suggested due to PRE
- (ii)
 - LifeCo would not qualify for Par treatment in MCCSR due to their dividend management practices
 - The company must regularly review the dividend scale (at least annually) and demonstrate to OSFI that elements of experience are passed through the annual adjustment. LifeCo would NOT be able to demonstrate to OSFI this as they have not passed through the investment losses over 10 years.
 - They must demonstrate that shortfalls are substantially recovered within a period not exceeding 5 years

4. Continued

- (d) Describe four methods that can be used to allocate investment experience between the par and non-par blocks of business.

Commentary on Question:

Most candidates were able to identify and describe a subset of the four methods

- Allocation of specific Assets
 - Each segment is assigned specific assets in an amount equal to its total liabilities and surplus. Investment income allocated is a function of the earnings on the assets allocated to each segment. Sharing of assets may be appropriate so long as the investment strategies of the segments are consistent with the assets allocated.
- Mean Fund Method
 - Company manages a single pool and allocates investment income in proportion to liabilities, or liabilities + surplus in each of the funds
- Investment Generation Method
 - Can also be used for allocating within participating sub accounts
- Combination approaches
 - It is acceptable to use a combination of the above approaches, so long as the participating accounts are not disadvantaged by these methods

- (e) Calculate the investment income allocated to the par fund in 2016. Show all work.

Commentary on Question:

Most candidates performed well on this part. For candidates who did not calculate the correct PfAD, partial marks were awarded for following the calculation through using their calculated values.

- 1) Calculate the PfAD for the Par and Non-Par blocks of business

	Non-Par	Par
<i>Interest</i>	<i>3</i>	<i>1</i>
<i>Mortality</i>	<i>12.5 – 12 = 0.5</i>	<i>5.3 – 5.0 = 0.3</i>
<i>Lapse</i>	<i>Max (13 – 12, 11 – 12) = 1</i>	<i>Max (4 – 5, 7 – 5) = 2</i>
<i>Expenses</i>	<i>12.2 – 12 = 0.2</i>	<i>5.2 – 5 = 0.2</i>
Total Pfads	4.7	3.5

- 2) Calculate the total PfADed reserve for each block of business

	Non-Par	Par
<i>Best Estimate</i>	<i>12</i>	<i>5</i>
<i>PfAD</i>	<i>4.7</i>	<i>3.5</i>
Total Reserve	16.7	8.5

4. Continued

3) Calculate the ratio of investment income allocated to the par fund
= Par Assets / Total Segment Assets

$$= 8.5 / (8.5 + 16.7) = 33.7\%$$

4) Calculate the allocated Investment Income

= Ratio * Total Segment Invested Income

$$= 33.7\% * 2 = \mathbf{0.67}$$

5. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2b) Recommend appropriate valuation assumptions.

Sources:

CIA Educational Note: Best Estimates Assumptions for Expenses – November 2006

CIA Educational Note: Margins for Adverse Deviations (MfAD) – November 2006

LFV-634-16: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, March 2015

Commentary on Question:

This question tested the candidate's knowledge of setting expense assumptions.

Solution:

- (a) Identify the expenses to include when calculating the CALM reserve for XYZ Life.

Commentary on Question:

The part of the question required the candidate to list only those expenses used in the calculation of the CALM reserve.

Should only include expenses used to calculate the CALM reserve. Expenses included in the CALM reserve include:

- Commission – Renewal
- Finance & Accounting
- Human Resources, Legal Services & Regulatory
- IT Costs for Administration & Applications
- Benefit Processing
- Customer Support - Policy Administration
- Depreciation Expenses
- Claims Litigation Expenses
- Premium tax
- Corporate Executive Oversight

- (b) List the methods which may be used to allocate corporate and overhead expenses to expense classes.

5. Continued

Commentary on Question:

Most candidates received full credit for this part of the question. Identifying 4 of the 6 items correctly gave the candidate maximum marks.

There are 6 methods available.

- Activity-based
- Expense based
- In force-based
- Staff based
- Time study-based
- Transaction-based

- (c) Determine the best estimate maintenance expense per policy and benefit expense per claim.

Commentary on Question:

Most candidates did not address all correct maintenance expense items. Credit was awarded only for those maintenance expenses that should be included in the calculation. Specifically, focus was placed on including budgeted non-recurring expenses, and excluding the impact of the administration project on the maintenance expenses.

To obtain full credit, the candidate was required to separate out renewal commissions and premium taxes since they are not subject to margins for adverse deviation. Some candidates did not include litigation expenses in the calculation of the benefit expense per claim.

5. Continued

<u>Maintenance expenses (in '000s)</u>	<u>Whole Life</u>	<u>SPDA</u>
Finance & Accounting	7,500	1,500
Human Resources, Legal Services & Regulatory	2,500	500
IT Costs for Administration Systems & Applications	30,000	5,000
Customer Support – Policy Administration	31,000	6,000
Annual Depreciation Expenses (excluding Project # 2)	6,200	800
Corporate Executive Oversight	15,000	2,000

Calculations (excl. Mfad) for either the WL or SPDA product done separately	Whole Life	SPDA
Maintenance Expenses (excl. Commission and Premium Tax) not subject to Mfad	92,200,000	15,800,000
Number of Policies in Force @ End of 2016	1,000,000	100,000
Maintenance Expense / Policy	\$92.20	\$158.00
plus: Budgeted non-recurring annual expenses (project 2)	\$3.00	\$1.00
less: Impact of Project # 2 on lower on-going Maintenance expense / policy	\$4.00	\$2.00
Final Maintenance Expense / Policy used in CALM valuation	\$91.20	\$157.00

<u>Benefit expenses</u>		
Benefit Processing	2,500	1,000
Claims Litigation Expenses	500	0
Benefit Expenses incl. Claims Litigation	3,000,000	1,000,000
Number of Claims Paid	1,500	4,000
Benefit Expense / Paid Claim	\$2,000.00	\$250.00

- (d) Recommend the maintenance expense margin for adverse deviation (MfAD). Justify your answer.

Commentary on Question:

Most candidates answered this section correctly, and identified the range for the expense margin assumption. A specific margin recommendation was required along with justification.

5. Continued

The recommendation should be between low and high margin. Low margin situation is 2.5%. High margin is 10%. Average of high and low margin (6.25%) applies since future experience is difficult to estimate and specific expense risk exists. However, given the limited information, use the high expense margin is acceptable as future experience is impossible to determine and no detailed expense study was provided

- (e) Determine the provision for adverse deviation (PfAD) for the premium tax on the whole life product as at the end of 2016.

Commentary on Question:

Premium tax is not subject to Mfad and thus no Pfad is required. Explicitly stating both of these facts will give the candidate full marks.

Premium tax is not subject to Mfad. Since Mfad is zero, then Pfad is zero

6. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2a) Describe valuation methods.
- (2b) Recommend appropriate valuation assumptions.

Sources:

CIA Educational Note: Valuation of Universal Life Policy Liabilities, February, 2012

CIA Educational Note: Investment Assumptions Used in the Valuation of Life and Health Insurance Contract Liabilities Sept. 2014

CIA Educational Note: Currency Risk in the Valuation of Policy Liabilities for Life and Health Insurers, December 2009

LFV-637-13: OSFI letter evidence for mean reversion in equity prices

Commentary on Question:

This question tests the candidate's knowledge of investment risks associated with a Universal Life product. The candidate has to demonstrate knowledge and application of the '20-20-75 limit' rule in determining maximum non-fixed income asset allocation.

Other important concepts tested include market shift and mean reversion of equities. Candidates are expected to identify concerns when foreign currency is introduced in the asset allocation and explain key considerations in assumption setting for foreign exchange rate.

Solution:

- (a) Describe four risks to Alpha if it were to back its UL product with an investment in equities.

Commentary on Question:

Candidates generally did well on this part of the question. Candidates were only required to describe four risks, but a complete list is provided in the solution. Few candidates had an insufficient or incorrect explanation of the risks.

Market Risk - equity market will move in a direction that is detrimental to the insurer. For instance, if an insurer were relying on the proceeds from a sale of equities to provide for cash flows that have to be met on a life insurance product, a fall in equity values would result in the insurer having to find resources from elsewhere to meet these cash flows.

6. Continued

Basis Risk - asset returns will be different from those credited to policy owners.

Currency Risk - Mismatch between earned rate and credited rate that is denominated in a different currency. If foreign market index returns are credited to the policy owners' account, the insurer could be exposed to currency risk.

Counterparty/Credit Risk - the risk that a party to a financial transaction will not meet its contractual obligations.

Liquidity Risk - the inability to buy or sell assets quickly at a fair price.

Volatility Risk - the risk associated with changes in volatility of equity markets.

Taxation risk - particular tax situations, especially those that are overly favorable to the insurer, may not continue indefinitely.

- (b) Calculate the maximum non-fixed income assets allowed to be held at the start of projection year 19 according to the '20-20-75 limit' rule. Show all work.

Commentary on Question:

Candidates generally provided a correct definition of the "20-20-75 limit" rule. However, not all candidates correctly applied the rule in the calculation. A common error was forgetting to floor the year 19 liabilities at zero. Most candidates struggled with the discounting rates for the cash flows.

Definition of the '20-20-75 limit' rule: The maximum amount of NFI assets is calculated by discounting "20% of cash outflows for the first 20 years and 75% thereafter, where cash outflows are the greater of the annual liability cash flows and zero in each forecast period."

The annual liability cash outflow is equal to the total cash outflows, which include benefits and expenses less premiums.

$$T_{19} = \text{Max}(0, 100 + 10 - 200) = 0$$

$$T_{20} = 200 + 10 - 200 = 10$$

$$T_{21} = 300 + 10 - 200 = 110$$

The 20-20-75 limit is calculated at each projection period independently. NFI holdings at period start are limited to the present value of cash outflows supported by NFI at time 19. Maximum NFI at each duration:

$$T_{19} = 0 * 20\% = 0$$

$$T_{20} = 10 * 20\% = 2$$

$$T_{21} = 110 * 75\% = 82.5$$

6. Continued

The maximum amount of NFI at duration 19 is:

$$\text{Maximum NFI} = 0 + 2 / (1+3.3\%)^2 + 82.5 / (1+3.4\%)^3 = 76.5$$

- (c) For this recommended allocation:
- (i) Identify any concerns.
 - (ii) Describe the method to determine an appropriate foreign exchange rate assumption.
 - (iii) Propose an appropriate foreign exchange rate MfAD. Justify your proposal.

Commentary on Question:

Candidates generally did well on part (i). Candidates recognized the mismatch in assets and liabilities and currency risk when Hang Sheng index is added to the asset allocation. Few candidates addressed the increase in volatility when foreign exchange rate is involved. Candidates failed to discuss the requirement to include foreign exchange rate assumption.

Most candidates correctly described using forward rates to derive the foreign exchange rate assumption in part (ii).

Candidates received marks for recognizing the prescribed 5% minimum margin and using one standard deviation of the change in the exchange rate to capture volatility for part (iii). Most candidates missed the point that the length of time for scenario testing needs to be consistent with duration over which currency mismatch is expected to occur. Few candidates recognized the volatility inherent in foreign exchange rate assumption, thus warranting a high MfAD.

- (i) Potential concerns:
- a. Exchange rates can be very volatile in both the short and long term
 - b. Currency risk is not hedged. Company is exposed to substantial risks of incurring losses when liabilities and assets are denominated in different currencies
 - c. Asset and liability mismatch is introduced when Canadian liabilities are partially back by assets in Hong Kong currency
 - d. According to the Standards of Practice, a foreign exchange rate assumption is required when policy liabilities and underlying assets are denominated in different currencies

6. Continued

- (ii) Based on currency forward between Hong Kong dollar and Canadian dollar (The base scenario assumption would be taken directly from currency forwards, or their equivalent. When currency forwards are not readily available, risk-free interest rate differentials can be used to derive a forward rate).

$$F = S * [(1 + i_f) / (1 + i_d)]^m \text{ where,}$$

F = Forward exchange rate

S = Current spot exchange rate

i_f = Risk-free interest rate in domestic currency

i_d = Risk-free interest rate in foreign currency

m = Term to maturity

The underlying theory is that of interest rate parity – a relationship must hold between the spot exchange rates of two currencies to eliminate arbitrage opportunities.

- (iii) Historical evidence indicates that currency volatility increases with time but decreases with the degree of integration of two economies. To establish a provision for adverse deviations, the actuary would develop a scenario reflecting historical volatility of that exchange rate over periods consistent with the length of time over which the currency mismatch is expected to exist.

The provision for adverse deviations would be equal to the excess of the policy liability calculated using this scenario over the corresponding liability calculated using the base scenario. A minimum provision would apply as the difference in policy liability resulting from an adverse 5% margin applied to the exchange rate in base scenario.

An acceptable approach to reflect volatility including using one standard deviation of the change in the exchange rate as the measurement. The actuary would apply the standard deviation in the direction that produces higher reserves.

Best Estimate / MfAD for Market Shift Assumption:

Investment return assumption can allow for recent market experience, as long as expected return do not exceed historic benchmark return. MfAD for insufficiently diversified portfolio is 20% of capital gains and assumed market shift of 25%-40% depending on relative volatility of the portfolio to a well-diversified North American portfolio.

6. Continued

- (d) Assess the appropriateness of the investment return assumption.

Commentary on Question:

Candidates generally struggled with this part of the question. Some candidates recognized this part of the question was testing the concept of mean reversion in equity prices. Commonly identified issues include long term mean reversion is not supported by historical experience and equity put pricing.

Manager is claiming mean reversion, both short-term and long-term. It is necessary to differentiate short-term and long-term mean reversion.

Assuming long-term mean reversion would result in lower reserves and capital requirements.

Some researchers accept the existence of short-term reversion, but not long-term mean reversion. Mean reversion violates efficient frontier principles. Even if long-term mean reversion has occurred in the past, there is no guarantee it will happen again in future. Equity put option prices high, indicating the market does not think that long-term mean reversion exists.

OSFI does not believe it is prudent to assume long-term mean reversion, unless there is strong evidence.

7. Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

- (2b) Recommend appropriate valuation assumptions.

Sources:

CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002

CIA Educational Note: Margins for Adverse Deviations (Mfad) – November 2006

CIA Final Communication of a Promulgation of Prescribed Mortality improvement Rates Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2350) July 2011

Commentary on Question:

This question tested the candidate's knowledge of developing an appropriate mortality assumption.

Solution:

- (a) Describe the key advantages and disadvantages of the Normalized Method.

Commentary on Question:

Candidates generally did well on this part of the question. Most candidates were able to describe the key advantages and disadvantages of the Normalized Method.

Advantage:

1. The sum of expected claims for the sub-categories matches total expected claims, the number of sub-categories selected does not affect the overall results
2. All of the information is used: both total company and sub-category A/E ratios and credibility factors
3. The results are reasonable in extreme or limiting cases
4. The sub-category A/E ratios fall within the original range
5. Interactive effected between sub-categories may be captured
6. Simple to apply in practice
7. It is pragmatic, and satisfies the criteria for a good credibility method

Disadvantage:

There is no strong theoretical base

7. Continued

- (b) Calculate the expected mortality ratio for fully underwritten business under the Normalized Method, assuming industry mortality at 100% and full credibility of 3,007 deaths. Show all work.

Commentary on Question:

Candidates generally showed a good understanding of the stepwise formula and calculation.

Step 1:

Calculate the A/E mortality ratios and credibility factors for the total company and for each of the subcategories

Actual number of claims

$$\text{Non-Smoker: } 200 * 62\% = 124$$

$$\text{Smoker: } 50 * 78\% = 39$$

$$\text{Total company: } 124 + 39 = 163$$

Credibility factors:

$$\text{Non-Smoker: } \min(\sqrt{124/3007}, 1) = 0.20$$

$$\text{Smoker: } \min(\sqrt{39/3007}, 1) = 0.11$$

$$\text{Total company: } \min(\sqrt{(163)/3007}, 1) = 0.23$$

Step 2:

Calculate the total company blended expected mortality ratio and corresponding expected claims

Blended expected mortality ratio

$$\text{Total: } 23\% * 68\% + 77\% * 71\% = 70\%$$

Expected claims:

$$\text{Total: } 70\% * 250 = 175$$

Step 3: calculate the expected number of claims, using the claims and credibility of the sub-categories

$$\text{Non-Smoker: } 20\% * 62\% + 80\% * 68\% = 68\%$$

$$\text{Smoker: } 11\% * 78\% + 89\% * 85\% = 84\%$$

Expected number of claims

$$\text{Non-Smoker: } 66\% * 200 = 134$$

$$\text{Smoker: } 84\% * 50 = 42$$

$$\text{Total: } 134 + 42 = 176$$

Step 4: Normalize the A/E ratio and expected claims

$$\text{Non-Smoker: } 68\% * (175 / 176) = 67\%$$

$$\text{Smoker: } 84\% * (175 / 176) = 84\%$$

$$\text{Total: } 70\% * (175 / 176) = 70\%$$

7. Continued

- (c) Calculate the company's new aggregate duration 1 mortality rate for a male age 40. Show all work.

Commentary on Question:

Most candidates demonstrated the proper calculations in the initial steps. However, few candidates were able to calculate the new aggregated mortality.

The accelerated underwriting mortality:

Non-smoker: $0.5/1000 * 200\% = 1/1000$

Smoker: $0.5/1000 * 200\% * 250\% = 2.5/1000$

Total: $1/1000 * 90\% + 2.5/1000 * 10\% = 1.15/1000$

Proportion which is eligible to accelerated underwriting program: $70\% * 50\% = 35\%$; regular underwriting: 65%

The fully underwritten mortality:

Non-smoker and Smoker: $0.9 * 0.5/1000 + 0.1 * 0.5/1000 * 250\% = 0.575/1000$

The new aggregated mortality:

$= 35\% * 1.15/1000 + 65\% * 0.575/1000 = 0.78/1000$

- (d) Critique the following statements:

- A. *We anticipate that the poor mortality risks would select simplified issue, which will reduce the fully underwritten mortality. We should use the lowest margin prescribed for the fully underwritten mortality $MfAD (3.75/e_x)$, and double this margin for simplified issue $(7.5/e_x)$.*
- B. *The population mortality improvement rate is running higher than 2%. To build in conservatism, we should use 2% for all genders and ages as the mortality improvement assumptions for both the fully underwritten and the simplified issue products.*

Commentary on Question:

Most candidates correctly criticized the statements and provides the appropriate explanations.

7. Continued

A. Fully underwritten

- The company still has very low credibility (250 deaths) so it should not use the lowest margin.
- The margin should be at least the average of high and low margins, 9.375/ex (The margin for adverse deviations would be at least the average of the applicable high and low margin whenever at least one 'significant consideration' exists, or at least one other consideration is significant in the context of the valuation.)

Simplified issue products

- the margin should be higher than 9.375/ex due to the following reasons:
 - In addition to the low credibility, anti-selection is present from underwriting criteria; policy being issued with the minimal underwriting.
 - There have been recent changes in underwriting standards or methods of classification, i.e. new simplified underwriting program.
 - Future experience difficult to estimate: Untested refinements in underwriting criteria have been recently introduced.

B.

- 2% for all ages and genders is not an appropriate assumption for either block.
- The CIA Prescribed mortality improvement cap the mortality improvement at 2% (for attained age 0 - 40) and grades down at older ages.
- The mortality improvement is not gender specific.
- The fully underwritten mortality improvement and the simplified mortality improvement have the same assumptions may be controversial.
- According to SOP, the margin of deviation added on base mortality should be high enough to offset the mortality improvement gain applied on base mortality.

8. Learning Objectives:

4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:

- (4b) Apply methods and principles of embedded value.

Sources:

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009.

Commentary on Question:

This question tested the candidate's knowledge of embedded value concepts.

Solution:

- (a) Describe the differences in how economic and non-economic assumptions are developed.

Commentary on Question:

Most candidates tended to focus on the similarities between economic and non-economic assumptions instead of focusing on the differences.

Noneconomic assumptions should be "entity specific", and are developed based on a company's own experience, combined with industry data if the company's experiences are not credible enough.

Noneconomic assumptions need not be consistent with what the market's perception of what such assumptions should be.

Economic assumptions are readily observable in the market.

Economic assumptions are developed based on past experience and economic environment as it exists on the valuation date.

Economic assumptions apply broadly across the economy

- b) Describe considerations when setting the following:

- (i) Lapse rates
- (ii) Investment assumptions

Commentary on Question:

Most candidates did well describing considerations when setting lapse rates but weren't as well versed on the investment assumption considerations.

8. Continued

- (i) Lapse Rates
Lapse rate typically set by considering both industry data and a company's own experience, but tend to rely more on company-specific data, because of differences of product design, distribution systems and policyholder service models observed across companies.
Particularly consider the relationship between customer behavior, product design and investment performance. For example, shock lapse at the end of surrender charge period, or end of renewal term period; for flexible-premium products, consider both the distribution channel and the economic environment.
Generally lapse rates are set by both product type and duration.
- (ii) Investment assumptions
Investment returns are typically derived from a combination of the performance of the actual asset portfolios, company investment expenses, and expected default risks.
Investment expense should reflect the local territory accounting.
Reinvestment assumptions should be considered unless liability and assets are matched perfectly. Like investment return, reinvestment rate is adjusted for investment expenses and default Risk.
Investment assumptions should not capitalize excess return without reflecting any additional risk. For example, increasing the investment return by assuming higher credit spreads should be offset by making an additional allowance for increased risk, possibly through the cost of capital and the RDR.
- (c) Calculate:
- (i) The risk discount rate.
- (ii) The inforce book value at the beginning of the current year.
- (iii) The book profit from new business in the current year. Assume expected inforce book value at the end of the current year is 1,000 million, and total book profit for the current year is 500 million.

Show all work.

8. Continued

Commentary on Question:

Most candidates struggled with all 3 parts of this question. Candidates needed the answer from part (i) to get to the solution in part (ii) and part (iii) and needed the answer in part (ii) to get to the solution in part (iii). Credit was provided for part (ii) and part (iii) even if one of the earlier parts were answered incorrectly. Some candidates provided equations within each part to pick up partial credit. Many candidates did not calculate the New Business Expected Contribution which was the first step to answering the question.

Aggregate Expected Contribution (EC) = New Business EC(t) + Inforce Business EC(t) + Free Surplus EC(T)

$$EC_t = [VNB_t \times (1 + RDR)^{0.5}] + [(IBV_{t-1} + RC_{t-1}) \times RDR] + [FS_{t-1} \times i_t]. \quad (28)$$

Since:

$$NB\ EC = 0.5\ IFB\ EC$$

$$EC(t) = 290$$

$$FS(t-1) = 200$$

$$\text{Pretax Investment Return} = 12.5\%$$

$$\text{Effective Tax Rate} = 20\%$$

$$290 = NB\ EC(t) + 2 \times NB\ EC(t) + 200 \times 12.5\% \times (1 - 20\%)$$

$$NB\ EC(t) = 90$$

$$(i) \quad VNB * \text{SQRT}(1 + RDR) = NB\ EC(t)$$

$$85 * \text{SQRT}(1 + RDR) = 90$$

$$RDR = 12.1\%$$

$$(ii) \quad IFBEC = 2 \times NB\ EC$$

$$(IBV(t-1) + RC(t-1)) * RDR = 2 \times NB\ EC(t)$$

$$(IBV(t-1) + 350) * .121 = 2 \times 90$$

$$IBV(t-1) = 1137.60$$

(iii) Expected Inforce Book Value (EIBV) at the end-of period = Accumulation of beginning-of-period Inforce Book Value (IBV) at the RDR – Expected in-force Book Profit (BP) + Cost of Capital

$${}_{IFB}EIBV_t = [IBV_{t-1} \times (1 + RDR)] - {}_{IFB}BP_t + [(RDR - i_t) \times RC_{t-1}]. \quad (18)$$

$$RC(t-1) = 350$$

$${}_{IFB}EIBV(t) = 1000$$

8. Continued

$$1000 = 1137.60 \times (1 + 12.1\%) - \text{IFB}BP(t) + (12.1\% - 12.5\% \times (1 - 20\%)) \times 350$$
$$\text{IFB}BP(t) = 281.7$$

$$\text{Total } BP(t) = \text{New Business } PB(t) + \text{Inforce } BP(t)$$

$$\text{New Business } BP(t) = 500 - 281.7 = 218.3$$

9. Learning Objectives:

3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.
4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context. In addition the candidate will understand the Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC and Economic Capital.

Learning Outcomes:

- (3a) Describe emerging developments impacting Canadian valuation and International Financial Reporting frameworks, and assess their impact on the valuation of reserves and financial statements.
- (4g) Describe the MCCSR/RBC regulatory framework and the principles underlying the determination of Regulatory RBC.
- (4h) Compute the MCCSR for a life insurance company:
 - Identification of significant risk component.
 - Identification of Specialized product MCCSR requirements.
 - Interpreting results from a regulatory perspective.

Sources:

OSFI Guideline – Minimum Continuing Capital and Surplus Requirements (MCCSR) for Life Insurance Companies (January 1, 2015)

LFV-642-16: OSFI: Life Insurance Capital Framework Standard Approach – Jan 2015

Commentary on Question:

This question tested the candidate's knowledge of the current capital framework (MCCSR) as well as of the proposed future capital framework (LICAT).

Solution:

- (a) Calculate the following MCCSR ratios and recommend actions (if any) based on the results. Show all work.

Commentary on Question:

To receive full credit for this part of the question, the candidate had to demonstrate knowledge of the rules for determining both available and required capital under the current capital framework. In addition, the candidate had to understand how the capital ratios relate to the supervisory minimums and targets, and what action the regulator (OSFI) might take based on the results.

9. Continued

Several candidates did not correctly calculate the Net Tier 1 available capital. Common mistakes included excluding the goodwill and mortality improvement adjustments. Most candidates did not apply the maximum to the Tier 2 capital. Some candidates knew they needed an adjustment for goodwill; instead of properly incorporating into the calculation, some candidates would write 'ignore goodwill' and therefore did not perform the calculation correctly. Some candidates were confused between the 'minimum' and 'supervisory' targets, using the terms interchangeably.

(i) Total Ratio

Required Capital = C-1 risk + Mortality, morbidity and lapse + C-3 = 100
Gross Tier 1 = Common shareholder's equity = 90

Deductions:

Goodwill = 20

Mortality improvement recognized in liabilities = 105 – 100 = 5

Net Tier 1 = 90 – 20 – 5 = 65

Tier 2 = Subordinated Debt = 80

But Tier 2 is subject to a maximum of Net Tier 1

Tier 2 = min (subordinated debt, net tier 1) = min (80,65) = 65

Available Capital = Net Tier 1 + Tier 2 = 65 + 65 = 130

Total ratio = 130 / 100 = 130%

Supervisory Targets:

Minimum ratio = 120%

Supervisory target = 150%

The total ratio is above the minimum ratio but below the supervisory target ratio. The Company must establish a plan to restore the ratio to at least the supervisory target ratio. The Company would also consider its own internal target, which is typically higher than the supervisory target. The plan improve the capital ratio could involve raising capital or making strategic changes such as divesting a portion of the business.

9. Continued

(ii) Tier 1 Ratio

$$\begin{aligned}\text{Tier 1 ratio} &= \text{Net Tier 1} / \text{Required Capital} \\ &= 65 / 100 = 65\%\end{aligned}$$

Supervisory Targets

Minimum Ratio = 60%

Supervisory Target = 105%

Similar to the Total Ratio, the Tier 1 Ratio is above the minimum but below the supervisory target. The Company will need to assess its business risks and put in place a plan to address the findings of the assessment.

- (b) Describe the primary differences between the overall MCCSR framework and the 6th Quantitative Impact Study (QIS6) capital framework.

Commentary on Question:

To receive full credit for this part of the question, the candidate had to demonstrate understanding of the significant differences between the current capital framework and the proposed future capital framework.

Under MCCSR, required capital is calculated and held in addition to liabilities, whereas QIS uses a total asset requirement (TAR) approach.

Under QIS, the TAR = the best estimate liabilities (BEL) plus a solvency buffer, which are calculated using a specified rate.

The BEL is calculated using year-end cash flows determined without risk margins.

The solvency buffer is calibrated to CTE(99) and is calculated using level, volatility and catastrophe shocks.

QIS allows for diversification credit for offsetting risks

QIS includes an explicit provision for operational risk, whereas it is allowed for implicitly under MCCSR.

9. Continued

- (c) At acquisition, Mardella Life's Common Shareholder Equity is reduced by 18.
- (i) Calculate the change in Total Ratio for Mardella Life due to this acquisition. Show all work.
 - (ii) Assess the company's capital position post acquisition and recommend actions (if any).

Commentary on Question:

To receive full credit for this part of the question, the candidate had to demonstrate knowledge of the rules for determining both available and required capital under the current capital framework. In addition, the candidate had to understand how the capital ratios relate to the supervisory minimums and targets, and what action the regulator (OSFI) might take based on the results.

Most candidates correctly determined the change in required capital. Several candidates did not adjust for the change to available capital in determining the change to the ratio.

There is no requirement for Block L, as the earned and credited rates are identical. For block M, capital is calculated as 100% - minimum correlation factor (CF) over the last four quarters, where :

$$CF = \text{Correlation}(X,W) \times \min(\text{std}(X), \text{std}(W)) / \max(\text{std}(X), \text{std}(W)).$$

By quarter, the CFs are

$$\begin{aligned} \text{Q1: } & 0.9 \times 0.9 / 0.95 = 0.8526 && \text{MIN} \\ \text{Q2: } & 0.96 \times .054 / .055 = 0.9425 \\ \text{Q3: } & 0.9 \times 0.15 / 0.15 = 0.9 \\ \text{Q4: } & 0.97 \times 0.19 / 0.2 = 0.9215 \end{aligned}$$

$$\begin{aligned} \text{Capital factor} &= 100\% - 85.26\% = 14.74\% \\ \text{Req'd capital change} &= 150 * 14.74\% = 22.11 \end{aligned}$$

$$\begin{aligned} \text{Available Capital} &= 130 - 18 = 112 \\ \text{Required capital} &= 100 + 22.11 = 122.11 \\ \text{MCCSR} &= 112 / 122.11 = 91.7\%. \text{ This is a drop of } 38.3\%. \end{aligned}$$

As this is below the minimum target, the Company will need to take immediate steps to rectify this position, either by raising capital or possibly by divesting the recently acquired blocks.

10. Learning Objectives:

5. The candidate will be able to evaluate various forms of reinsurance, the financial impact of each form, and the circumstances that would make each type of reinsurance appropriate.

Learning Outcomes:

- (5a) Describe the considerations and evaluate the appropriate reinsurance form from the ceding and assuming company perspectives.
- (5b) Explain the consequences and calculate the effect on both ceding and assuming companies with respect to:
- (i) Risk transfer
 - (ii) Cash flow
 - (iii) Financial statements
 - (iv) Reserve credit requirements
 - (v) Tax

Sources:

Life, Health & Annuity Reinsurance, Tiller, 3rd Edition, Ch 4 & 5

CIA Standards of Practice

CIA Ed Note: Accounting for Reinsurance contracts under IFRS

Commentary on Question:

This question tests the candidate's ability to construct the balance sheet under two different reinsurance structures.

Solution:

- (a) Calculate the following for each reinsurance offer under the Canadian Asset Liability Method (CALM), assuming no margins for adverse deviation, income tax or premium tax:
- (i) Gross contract liability at issue
 - (ii) Reinsurance asset at issue

Show all work.

Commentary on Question:

Most candidates were able to calculate the correct Gross Reserve but struggled when calculating the Reinsurance Assets. Common mistakes for the Coinsurance piece were ignoring the Expense Allowance or basing it on a figure other than the Reinsurance Premium. On the YRT portion, many candidates struggled to calculate the correct Reinsurance Premium but received partial credit for the Death Benefit Calculation.

10. Continued

Note – For rounding and simplicity, the mortality decrement was excluded from the year 2 and 3 values in the solution below. Candidates were not penalized for including or excluding a mortality decrement in their model.

Assumptions:

Prem/1000 = 0.55

Face = \$10MM

Issue Expense = 600

Annual Expense = 50

$i = 0\%$ (because it is invested in Cash)

Gross Reserve Calculation

Mortality Rates/1000:

year 1	year 2	year 3
0.35	0.65	0.74

	year 1	year 2	year 3	Total
Premium	5,550	5,550	5,550	16,500
Expense	-650	-50	-50	-750
Death Benefit	-3,500	-6,500	-7,400	-17,400
Net Cashflow	1,350	-1,050	-7,400	-1,650
Gross Reserve				1,650

Premium = Face * Premium/1000

Expense = as given

Death Benefit = Face * q_x

Coinsurance Reserve Calculation

	year 1	year 2	year 3	Total
Premium	5,550	5,550	5,550	16,500
Reinsurance Premium	-4,400	-4,400	-4,400	-13,200
Expense	-650	-50	-50	-750
Expense Allowance	440	440	440	1,320
Death Benefit	-3,500	-6,500	-7,400	-17,400
Reinsured DB	2,800	5,200	5,920	13,920
Net Cashflow	190	190	10	390
Net Reserve				-390
Reinsurance Asset				2,040

10. Continued

Premium, Expense, Death Benefit unchanged from Gross Reserve
 Coinsurance % = (Face – Retention) / Face = (10MM – 2MM) / 10MM = 80%
 Reinsurance Premium = Premium * Coinsurance %
 Expense Allowance = Reinsurance Premium * Expense Allowance (10%)
 Reinsured Death Benefit = Death Benefit * Coinsurance %
 Reinsurance Asset = Gross Reserve – Net Reserve

YRT Reserve Calculation

YRT Rates/1000:

year 1	year 2	year 3
0.273	0.336	0.672

	year 1	year 2	year 3	Total
Premium	5,550	5,550	5,550	16,500
Reinsurance Premium	-2,750	-3,380	-6,740	-12,870
Expense	-650	-50	-50	-750
Death Benefit	-3,500	-6,500	-7,400	-17,400
Reinsured DB	2,450	4,550	5,180	12,180
Net Cashflow	1,050	120	-3,510	-2,340
Net Reserve				2,340
Reinsurance Asset				-690

Premium, Expense, Death Benefit unchanged from Gross Reserve
 YRT % = (Face – Retention) / Face = (10MM – 3MM) / 10MM = 70%
 Cession Fee = 20
 YRT Rate = $q_x^{\text{Industry}} * 60% * \text{YRT \%} + \text{Cession Fee}$
 Reinsurance Premium = Face * YRT Rate
 Reinsured Death Benefit = Death Benefit * YRT %
 Reinsurance Asset = Gross Reserve – Net Reserve

- (b) Explain why NHL Re's assumed liabilities would not equal MLB Life's reinsurance asset.

Commentary on Question:

Most candidates were able to identify that the reserve would be different. However, candidates did not provide sufficient justification as to why.

10. Continued

- Mirroring reserves where both the cedant and reinsurer have the exact same assumptions is not permitted
 - The reserves will be different because:
 - Each actuary/company is responsible for determining their own assumptions based on their unique experience
 - Mortality experience will likely be different between the two companies
 - Other assumptions (persistence, investment returns, etc.) would also differ
- (c) Describe how an impairment of NHL Re would affect MLB's balance sheet for each of the reinsurance offers.

Commentary on Question:

Most candidates were able to identify that MLB's net liability would be impacted by an impairment of NHL Re.

- MLB would expect no change to gross liability
- The Coinsurance Asset would be reduced by the provision related to recovery
- The YRT Asset would be reduced by the provision related to recovery
 - The YRT Asset would become more negative
- As a result of the impairment, MLB's net reserve would change

11. Learning Objectives:

1. The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.

Learning Outcomes:

- (1c) Describe how to compute the taxable income of a life insurance company.

Sources:

Canadian Insurance Taxation, Borgmann et. al., 3rd Edition, Ch. 3, 4, 5, 6, 11, 27

Commentary on Question:

This question tested the candidate's knowledge of Insurance Taxation rules.

Solution:

- (a) Calculate the premium tax payable for Canadian business in 2015. Show all work.

Commentary on Question:

Few candidates answered this question correctly. Common errors candidates made were to apply the tax rates to premium income net of reinsurance or gross premium. The correct method was to apply to the tax rates to premium income net of dividends paid.

Premium Tax Ontario = (Premium income - dividends) × (% Ontario) × tax rate
Ontario

$$= (40 - 3) \times 0.5 \times 0.02 \\ = 0.37$$

Premium tax Quebec = (Premium income - dividends) × (% Quebec) × tax rate
Quebec

$$= (40 - 3) \times 0.5 \times .023 \\ = 0.4255$$

Total premium tax = 0.37 + 0.4255 = 0.7955

- (b) Calculate LT Life's Canadian Federal and Quebec Taxable Income for 2015. Justify all values used, including any assumptions made. Show all work.

Commentary on Question:

Most candidates missed some part of this calculation. Common mistakes included incorrect treatment of uncollectable items and the omission of non-deductibility of IIT in Quebec.

Taxable Income before adjustment of uncollectable items:

Only include values in Canada.

11. Continued

$$\begin{aligned}\text{Net Premium Income} &= \text{Premium Income} - \text{Reinsurance Premium Paid} \\ &= 40 - 8 \\ &= 32\end{aligned}$$

$$\begin{aligned}\text{Net Claims Paid} &= \text{Claims Paid} - \text{Reinsurance Claims Received} \\ &= 30 - 6 \\ &= 24\end{aligned}$$

$$\text{Premium Tax Paid} = 0.7955 \text{ (from part a)}$$

$$\begin{aligned}\text{Taxable Income Before Adjustment of Uncollectable Items} \\ &= \text{Net Premium Income} + \text{Investment Income} - \text{Net Claims Paid} \\ &\quad - \text{Increase in MTAR} - \text{Dividends Paid} - \text{IIT Paid} - \text{Premium Tax Paid} \\ &= 32 + 12 - 24 - 7 - 3 - 1 - 0.7955 \\ &= 8.2045\end{aligned}$$

To obtain full credit, candidate needs to explain the deduction of dividends. Candidate can assume full deduction of dividends or limit the deduction to insurer's cumulative income from participating business in Canada for current and preceding years, less dividends previously paid.

\$2 million uncollectable residential mortgage: up to 100% deductible
\$1 million uncollectable life insurance premium receivable: No credit allowed
\$3 million in doubtful corporate bonds: up to 90% allowed to be deducted

$$\begin{aligned}\text{Total Federal Taxable Income} \\ &= \text{Taxable Income before adjustment of uncollectable items} \\ &= 8.2045 - 100\% \times 2 - 0 - 90\% \times 3 \\ &= 3.5045\end{aligned}$$

IIT paid is not deductible for Quebec Taxable Income.

$$\text{Quebec Taxable Income} = (3.5045 + 1) \times 0.5 \text{ (half of business in Quebec)} = 2.25225$$

- (c) Assess the accuracy of each of the following statements regarding the calculation of LT Life's 2015 Canadian taxes payable:

A. *The method used to determine the MTAR is:*

- *Pre-1996 policies: 1.5 Year Full Preliminary Term*
- *Post-1995 policies: As reported in the financial statements*

B. *IIT is calculated using a tax rate of 10% of the Corporate Bond yield multiplied by (MTARs less Policy Loans) on all life insurance policies.*

11. Continued

C. The transfer of a debt security between the life and non-life business does not affect the tax treatment of that security.

Commentary on Question:

To receive full credit, candidates were required to state whether each statement was True or False and provide justification. Candidates generally performed well with the first two statements but did not make correct assessments with the third statement.

(A) FALSE

As of Jan 1, 2007, there is no longer a distinction required for insurance policies written before 1996 and after 1995. All MTARs are determined based on amounts included in insurers' financial statements.

(B) FALSE

IIT is determined using $\text{Life Investment Income} = \text{Prescribed yield} \times \text{MTAR}$

Prescribed yield is based on moving average interest rate of Gov't of Canada bonds.

$\text{IIT} = 15\% \text{ of Taxable Canadian Life Investment Income} = 15\% \text{ of (Life Investment Income +/- Experience Rating Refund - Amounts reported to Policyholders - Canadian Life Investment Loss Carryforward)}$

(C) TRUE

Prior to 1994, transfer from an insurer's life business to its non-life business, or vice versa, would have been deemed a disposition and transferred at fair market value. This rule has since been repealed.